

Claims

1. A positive active material for a secondary battery comprising β -FeOOH that contains at least one element selected from the group consisting of B, P, S, Li, Na, K, Mg, Al, Ca, Sc, Ti, V, Cr, Mn, Co, Ni, Cu, Zn, Zr, Pb and Sn and that shows a diffraction peak from the (110) plane having a half width γ satisfying $0.3^\circ < \gamma$ (2θ) when subjected to X-ray diffractometry with the $\text{CuK}\alpha$ ray.

2. A process for the preparation of a positive active material for a secondary battery according to Claim 1 which comprises a step of hydrolyzing an aqueous solution, in which an iron salt and a salt containing at least one element selected from the group consisting of B, P, S, Li, Na, K, Mg, Al, Ca, Sc, Ti, V, Cr, Mn, Co, Ni, Cu, Zn, Zr, Pb and Sn are dissolved, at a temperature of from 40°C to 100°C .

3. A process for the preparation of a positive active material for a secondary battery according to Claim 2, wherein said iron salt is ferric chloride, said vanadium salt is VOSO_4 , and said aqueous solution contains FeCl_3 and VOSO_4 together dissolved therein at a molar ratio satisfying $0 < (\text{VOSO}_4/\text{FeCl}_3) < 0.1$.

4. A positive active material for a secondary battery comprising β -FeOOH that has particles with an aspect ratio of not greater than 5 and that shows a diffraction peak from the (110) plane having a half width γ

satisfying $0.3^\circ < Y(2\theta)$ when subjected to X-ray diffractometry with the $\text{CuK}\alpha$ ray.

5. A positive active material for a secondary battery comprising $\beta\text{-FeOOH}$ that has particles with a mode diameter of not greater than $10\text{ }\mu\text{m}$ and that shows a diffraction peak from the (110) plane having a half width Y satisfying $0.3^\circ < Y(2\theta)$ when subjected to X-ray diffractometry with the $\text{CuK}\alpha$ ray.

6. A positive active material for a secondary battery according to Claim 4 or 5, wherein said positive active material further contains at least one element selected from the group consisting of Li, Na, K, Mg, Al, Ca, Sc, Ti, V, Cr, Mn, Co, Ni, Cu, Zn, Zr, Pb and Sn.

7. A positive active material for a secondary battery according to Claim 4 or 5, wherein the amount of said at least one element selected from the group consisting of Li, Na, K, Mg, Al, Ca, Sc, Ti, V, Cr, Mn, Co, Ni, Cu, Zn, Zr, Pb and Sn is not smaller than 0.1 wt%.

8. A process for the preparation of a positive active material according to Claims 4 to 7, which comprises a step of hydrolyzing an aqueous solution, in which ferric chloride and a salt containing at least one element selected from the group consisting of Li, Na, K, Mg, Al, Ca, Sc, Ti, V, Cr, Mn, Co, Ni, Cu, Zn, Zr, Pb and Sn are dissolved, at a temperature of from 40°C to 100°C .

9. A non-aqueous electrolyte secondary battery comprising the following elements:

(1) a negative electrode comprising a negative active material capable of inserting and extracting lithium ion and/or metallic lithium;

(2) a positive electrode comprising a positive active material according to any one of Claims 1, 4, 5, 6 or 7; and

(3) an electrolyte in contact with said negative electrode and positive electrode.